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Curriculum RP-21

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THE MINISTER OF EDUCATION



ONTARIO

DEPARTMENT OF EDUCATION

# A G R I C U L T U R E

INTERMEDIATE AND SENIOR DIVISIONS

GRADES 9 TO 12

*For Introduction in Grade 9 in*

*September, 1962*

These courses are experimental in that they will be subject to review.

Suggestions for their improvement will be welcomed.

## INTRODUCTION

"Unstable is the future of the country which has lost its taste for Agriculture. If there is one lesson in history which is unmistakable it is that the national strength lies very near the soil." - Daniel Webster

Improvements in farming methods during the past twenty years have resulted in larger farms, fewer farmers and a greatly increased output of agricultural products. The percentage of the labour force in agriculture in Canada has dropped from twenty-six in 1946 to approximately eleven at the present time. Although fewer are primary producers of food the number involved in industries directly related to agriculture has reached an all time high.

This course is designed to teach something of the basic sciences as they pertain to agriculture. Attention is given to principles rather than to practical agriculture. The field relating to the latter is well served in this province by extension specialists co-operating with the county Agricultural Representative. The aims of the courses are:

1. To teach the history of agriculture - both local and world wide; to give pupils some knowledge of the role of Agriculture in the rise and fall of civilizations; to show effect of the misuse of land resources
2. To develop an appreciation of the environment we enjoy in this province and the knowledge gained from a close association with plant and animal life
3. To provide an appreciation of the fundamental life processes; the role of the basic sciences in the fields of chemistry, physics, biology, and microbiology, as they pertain to the production of food, and in the principles of the nutrition of plants and animals
4. To teach an appreciation of the role of agriculture in our economy and the basic economics of the industry
5. To give pupils an appreciation of the universal dependence of man upon soil, its composition, management and conservation.

It is expected that some time will be devoted to expanding some of the topics or in practical activities related to the courses. Optional topics are marked with an asterisk.

GRADE 9

I. HISTORY OF AGRICULTURE (6 periods)

- (1) Plants indigenous to North America; early agricultural developments in Canada.
- (2) Development of agricultural areas in Ontario
- (3) Review counties of Ontario and crop distribution
- (4) Local agricultural history with reference to pioneers of the area
- (5) Modern developments, types of specialization
- (6) Possible trends

II. PLANT SCIENCE (30 periods)

A. General -

- (1) Classification of plants - annuals, perennials, biennials, (review)
- (2) Growth habits - habitat, root types, seed production, longevity of various seeds
- (3) Common weeds of the locality; identification of twenty; pupil collection of ten
- (4) Economic importance of weeds
- (5) Principles of weed control - natural, cultural, herbicides; practical demonstrations
- (6) Introduction to weed control legislation; Weed Control Acts
- (7) Recognition of ten weed seeds; occurrence and removal of weed seeds in seed grain; the grades of seed grain

B. Horticulture

- (1) Study of methods of harvesting and storage of: - fruits and vegetables; horticultural plants (gladiolus, dahlia, canna, tuberous begonia, geranium)



- (2) Planting bulbs for outdoors; formal, informal designs; comparison of types

Planting bulbs to force indoor bloom; comparisons of natural and artificial light

- (3) Fall care of plants; winter plant damage; alternate freezing and thawing, girdling, wind, ice, and snow; methods of preventing damage

- (4) Planting seeds and transplanting of seedlings; observations of germination periods, comparisons of the effects of temperature, moisture, light, and depth; observation of root hairs and methods of avoiding damage in transplanting

- (5) Planting of various types of plants - deciduous shrub, evergreens, shade or fruit tree, hedge, rosebush

- (6) The maintenance and establishment of a lawn; soil types; drainage; seeding mixtures for various purposes; leveling; watering; weed controls; fertilizing; aeration

- (7) Study of plant material used in home beautification: annual, perennials, flowering shrubs, evergreens, trees, roses (Hybrid Tea, floribunda, climber)

- \*(8) Commercial harvesting of vegetables and fruits

- \*(9) Use of various plant growing structures: greenhouse, hotbed, coldframe

### III. SOILS (20 periods)

#### A. Rocks to Soil

- (1) Origin of igneous, sedimentary, and metamorphic rocks; recognition of specimen of each; the changes which may have occurred in these rocks; granite, limestone, shale, sandstone

- (2) Physical and chemical properties of rocks: physical (appearance, hardness, inclusions of minerals, fossils); chemical (principal

elements as in limestone; flame tests for sodium; dilute hydrochloric acid test on limestones)

- (3) Distribution of bed-rock: classification of local bed-rock to agriculture; reference to Precambrian area (igneous rock); mining, forestry, recreation
- (4) Agencies of weathering: action of winds, water, alternate freezing and thawing; lichens and very minute plant growth on rocks
- (5) Glaciation: presentation of evidence that climate has changed - prehistoric; identification and characterization of local physiographic features resulting from glaciation; soil survey maps and reports
- (6) Soil formation: weathering and glacial action: glacial till: chemical and physical processes; gradual accumulation of organic matter

#### B. Constituents of a Soil

- (1) Establish the presence of (a) organic material in various stages of decomposition; (b) rocks and minerals; (c) organisms
- (2) Establish the percentage composition of a desirable soil
- (3) Variation in soil constituents: natural variation in percentage by weight and by volume of the four constituents: organic, mineral, air, and water
- (4). Origin of sand, silt and clay; source, use, and description; microscopic observation

#### C. Physical Properties of Soils

- (1) Texture: a classification based on size of mineral particles; reference to common soil types
- (2) Structure: arrangement of mineral particles into aggregates or crumbs; single grain structure in sands; aggregates in clay; observe structural differences; the necessity of organic matter

- (3) Water-holding capacity: comparison or relative water absorbing capabilities of sand, clay, organic matter singly and in combinations
- (4) Capillary movement: in sand, clay and organic matter
- (5) Plasticity and shrinkage: relate occurrence of soil cracking to clay content; use of special clays and shales for brick, tile, and pottery manufacture

#### IV. ANIMAL SCIENCE (20 periods)

##### A. Live Stock

- (1) Importance of the live stock industry
- (2) Fluid milk trade of the dairy industry; Babcock test; Methylene Blue reduction test; sediment test for milk; discuss solids-not-fat
- (3) Breed identification, origin and characteristics (review); common live-stock terms

##### B. Poultry

- (1) History of domestic fowl - types and uses
- (2) The Egg - parts of an egg, quality, shell colour, grades
- (3) Poultry Meats - roasters, capons, broilers, ducks, geese, turkeys, turkey broilers, game fowl
- (4) Incubation - (a) Methods - natural, artificial
  - (b) The hatchability of chicken eggs as influenced by environment and heredity
  - (c) Incubation of eggs in the school incubator
  - (d) Observation of the developing embryo
- (5) Biological needs of poultry as related to housing - temperature, humidity, space, light, ventilation, insulation, litter

\*Beekeeping - Economic importance, care and management

\*Live-stock judging



V. AGRICULTURAL MATHEMATICS (20 periods)

- (1) Review square measure; land measure
- (2) Volumes - ponds, ditches, trench silo, bushels in bins, gallons in tanks, silos, materials for concrete
- (3) Plantings - plants per acre, bulbs per bed
- (4) Payments for milk at dairies, creameries, cheese factories
- (5) Use of graphs and charts for illustration and comparison

VI. AGRICULTURAL ENGINEERING (10 periods)

- (1) Farm and home safety: fire, physical obstacles, chemicals, electricity, animals, tractors and other machinery
- (2) Drawing scale plans of the farm, farm buildings or home
- \*(3) Seasonal care and storage of machinery, implements and tools
- \*(4) Rope work: - whipping, short splice, crown knot, eye splice, long splice, knots, halter, rope making

VII. FORESTRY (12 periods)

- (1) Importance of the study of Forestry - products and conservation
- (2) Leaf identification of (a) conifers - pines, spruces, cedars, hemlock, balsam, larch  
(b) main deciduous species of district
- (3) Reforestation - land, species, procuring seedlings, planting, care, services of your forester and local conservation authority
- (4) Farm woodlots - value products, management
- \*(5) Christmas tree production

AGRICULTURE

GRADE 10

I. AGRICULTURAL ENGINEERING (15 periods)

A. Tile drainage:

- (1) The advantages of tile drainage; field assistance available
- (2) Simple levels: carpenters level; line level, hand level
- (3) Surveyor's level and transit, proving the level, adjustments
- (4) The level book and entries
- (5) Practical experience in establishing grades
- (6) Plotting profiles and drains on graph paper; contours
- (7) System of drains; estimating costs; Tile Drainage Act

B. Use of Concrete:

- (1) Manufacture of cement
- (2) Experiments on the selection of aggregates
- (3) Composition of different mixes
- (4) Forms, reinforcing, finishing, curing

C. Reference to services of the Engineering Extension Specialist of the Ontario Department of Agriculture

II. GENETICS (15 periods)

(1) Introduction - Definition of genetics and heredity

Importance of genetics: an exact science leading to an understanding of the problems of inheritance

History of genetics as a science; early concepts -

Darwin; foundation of genetics as a science - Mendel

General applications to agriculture in the improvements of our domesticated animals and plants

(2) Genes and Chromosomes - Location, description, function

Dominant and recessive genes - a character expressed by one parent



which appears in the hybrid to the exclusion of the contrasted (recessive) character

Phenotype is the external appearance of an organism with a definite gene constitution related to its environment

Genotype - gene constitution of an organism

Homozygous - the union of gametes of similar genetic constitution

Heterozygous - the union of gametes of dissimilar genetic constitution

(3) Transfer of chromosomes and genes during cell multiplication

Mitosis-nuclear division of the somatic cell

Meiosis-the process by which the nucleus divides twice and the chromosomes once, giving daughter nuclei, each having half the number of chromosomes of the parent nucleus

(4) A study of monohybrid and dihybrid crosses with an explanation of the phenotypic and genotypic results

(5) Test crosses (a) to determine genotype of an organism of known phenotype  
(b) to determine the parental genotypes of a given organism

(6) Incomplete dominance (blending) - an explanation of the results of common occurrences in plants and animals

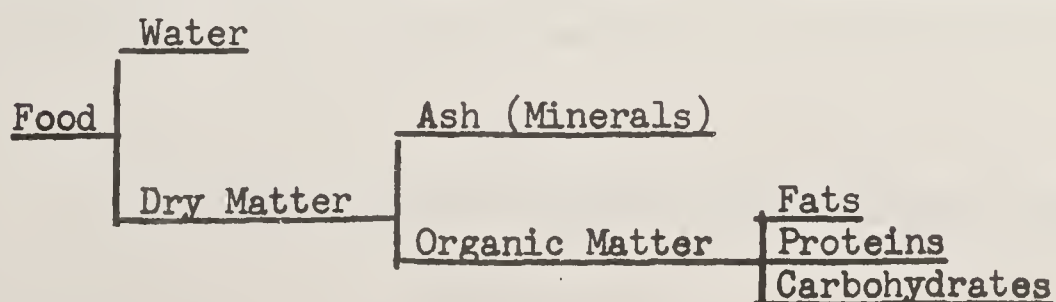
### III NUTRITION (16 periods)

(1) Review basic types of food: fats, proteins, carbohydrates, vitamins, minerals, water; chemical composition (where applicable); uses of each type to the animal body

Simple experiments to test for presence of fats, proteins, and carbohydrates in various food materials

\*Nutrition tests on animals, i.e. rats, chicks

(2) Basic composition of any food material



Experiments to determine percentages of water, dry matter, ash  
and organic matter in various food materials

- (3) Review the basic digestive processes in the animal body
- (4) (a) Special features of ruminant and poultry digestive tracts;  
(b) Dissection of the fowl
- \*(5) Classification of feeds: concentrates; roughages (dry and succulent feeds) - Characteristics, uses
- \*(6) Ration: (a) Definition  
(b) Requirements to be met by a balanced ration with respect to: growth, maintenance, fattening; energy, production of milk, wool; reproduction  
(c) Reference to composition of feeds: i.e. feed tables - Total Digestible Nutrients (T.D.N.); fibre; protein; Nitrogen Free Extract (N.F.E.); minerals  
(d) Factors considered in making a ration  
(i) Composition; (ii) Concentration; (iii) Balance;  
(iv) Palatability; (v) Availability of materials;  
(vi) Cost  
(e) Feeds Act - Reference to feed labels
- \*(7) (a) Simple Feeding Rules - pounds roughage and concentrate per unit of live weight or production  
(b) Balanced human diet - Canada's food rules; Food and Drug Act.

#### IV ECONOMICS (15 periods)

- (1) Agriculture in our economy: supply, production, processing, distribution, discuss, relate to employment, national income, exports
- (2) Introduction to a study of marketing services-local, provincial, and federal
- (3) Co-operatives in Ontario-early history and development

- (4) Farm accounts and unit costs of production
  - (a) Reasons for keeping accounts
  - (b) Kind of account to keep
  - (c) Components of farm accounts
    - (i) Inventories; (ii) Record of Expenses; (iii) Record of receipts
  - (d) Special accounts
  - (e) The farm record book
  - (f) Calculation of income tax
  - (g) Calculate cost of producing a crop or a product
- (5) Credit: sources of farm credit; instalment buying
- \*(6) Deeds; titles; mortgages; insurance on property, crop, and live stock; stocks, bonds
- \*(7) Municipal finance: mill rates, assessment, debentures

## V SOILS (20 periods)

### A. Soil formation and mapping

- (1) Variations in climate and vegetation - develop the relationships between climatic factors and vegetation on a regional basis (St. Lawrence Lowlands, Precambrian Shield)
- (2) Contribution of soil-forming materials - recall the distribution of bed-rock and glaciation; discuss the factors in soil formation in relation to specific deposits (sand, clay, or bed-rock):  
develop the concept of marked differences due to materials; refer to well-drained sites only (because they are more representative)
- (3) Effect of natural drainage - recall local physiographical features, organic matter, minerals, organisms, air and water to show that natural depressions or large areas of poor drainage will result in soil differences; inadequate drainage reflected in vegetative differences



- (4) A soil profile - introduce the concept of a soil having different layers as a result of the factors discussed in above; reference to county soil reports, or examination in the classroom of soil from different depths.
- (5) Soil Maps and Reports - with the aid of local soil reports and maps discuss major sections of a report. Discuss the applications depending on local conditions (students checking local areas, commercial use of gravel deposits, quarries)

#### B. Chemical Properties of Soils

- (1) Recognition and applicable characteristics of Carbon, Hydrogen, Oxygen, Nitrogen, Phosphorous, Potassium, Calcium
- (2) Recognition of acids and bases and use of indicators
- (3) Elements essential to plant growth major and minor
- (4) Formation of compounds; establish that essential elements occur naturally as compounds; common materials used in commercial fertilizers to supply elements
- (5) Soil pH - the natural pH to depend on:
  - (a) soil-forming material and bed-rock
  - (b) climate
  - (c) vegetation; estimate pH of samples of surface soils and soil horizons
  - (d) use of pH test kits
- (6) Total and available nutrients - recall solution of limestone by hydrochloric acid and its lack of solution on granite; develop
  - (a) the weak acid solution from root action, (b) insolubility of many compounds in weak acid, (c) only a small percentage of the total nutrient is available for plant use
- (7) Soil as a storehouse - an experiment to leach soil with dilute ferric sulphate solution. Add potassium thiocyanate. Note lack

of red colour indicating that iron has been adsorbed by soil. Develop  
(a) the process not a filtering action, (b) soil exchanged adsorbed  
elements for the iron, (c) similar exchange for plants

- (8) Role of organic matter and clay - repeat above experiment using  
different soils or sand, clay, organic matter, singly, and in  
combination to show the low adsorptive capacity of sand and higher  
adsorption for clay and muck
- (9) Climate and soil determine the vegetation - show the broad relation-  
ship existing between climate and soil and the vegetation, e.g. forests,  
grain growing, fruit growing, live stock, special crops and tobacco,  
sugar beets

C. Importance of soil testing; the type of information to be supplied by  
the grower and the information he receives; how to take a soil sample

## VI PLANT SCIENCE (30 periods)

### A. Field Crops

- (1) World food production potential and its importance
- (2) Early history of crop production
- (3) Creation of new varieties (a) natural selection (b) selection by man:  
example-Dawson's Golden Chaff winter wheat (c) plant breeding:  
example - Marquis wheat, Russel oats
- (4) Classification and distribution of field crops; their description;  
seed recognition; economic value:
  - (a) Cereals - wheat, oats, barley, rye, buckwheat, corn, millet
  - (b) Forage Crops - legumes and grasses; with reference to good hay  
and fodder production and pasture management
  - (c) Oil Crops - soybeans, rape, flax
  - (d) Root and Tuber Crops - potatoes, sugar beet, turnip
  - (e) Fibre - flax
  - (f) Special Crops - tobacco, beans, canning crops

- (5) Weed Control - types of herbicides and their use: selective, non-selective, sterilant, and growth inhibitors; experiments to show effect of the above
- (6) Production of registered seed; seed judging
- (7) Germination seed tests; reasons for testing; method-blotted, rag doll, seed germinator

#### B. Horticulture

- (1) Landscaping - The basic principles of landscaping a home should be of interest to both urban and rural pupils. The study involves design, choice of material, growth habits of plants and plant propagation:
  - (a) Review plant groups and fundamentals of planting
  - (b) Types of plantings: natural, formal
  - (c) Landscape plants - shape and height
  - (d) Development of landscape plan of the home: planning symbols, approach, private and service areas, layout and use of each of different plantings - foundation planting, shrub borders, perennials, annuals, roses, trees
- (2) Plant Propagation
  - (a) Natural: seeds, spores, suckers, stolons, underground stems
  - (b) Artificial: cuttings, division, layering, grafting, budding

#### C. House Plants

Recognition of a number of common house plants grown at the school; care and management; soils, repotting, feeding, watering, light, temperature

\*D. Planting and management of strawberries, raspberries, grapes

\*E. Planting, pruning, spraying, of tree fruits in the home garden. Reference to dwarf and semi-dwarf fruit trees



AGRICULTURE

GRADE 11

I HISTORY OF AGRICULTURE (8 periods)

- (1) This planet during cenozoic era; the development of North America; Canada; and Ontario
- (2) Man's struggle for food over the last 10,000 years. Natural food gathering, specialized food collection, the village farming community, the city states, pastoral nomadism, Roman agriculture, feudal agriculture.
- (3) Predictions of famine; increasing population, medical advances affecting the increase; lack of new lands to exploit; decrease of present production land
- (4) Reasons world famine not imminent: possible increase in production per acre, as affected by new varieties and fertilizers, disease and insect control; new sources of food
- (5) Modern production records and methods compared to those of 1900

II BIOLOGY (30 periods)

A. Biological Sciences - Since much of this course is concerned with a study of living matter, plants and animals, a survey of the divisions and subdivisions of the plant and animal kingdoms is in order:

- (1) Define - (a) Morphology - Anatomy, Histology, Cytology  
(b) Taxonomy (c) Physiology (d) Ecology (e) Genetics  
(f) Embryology (g) Pathology

(2) Classification of Animals

(a) Principal phyla - Protozoa, Annelida, Arthropoda, Chordata  
(Vertebrata)

(b) Discuss the Arthropoda and Vertebrata in respect to subphylum, class, order, family, genus, species

(c) Classify an insect, rodent, cow, horse

B. Insects

- (1) (a) Characteristics of the class Insecta and characteristics of the orders - Orthoptera, Coleoptera, Lepidoptera, Diptera,

Hymenoptera, Hemiptera, Homoptera, Odonata

Give examples of one insect in each of the above orders

- (b) (i) The honey bee as a social insect - physiology and social behaviour, life history; (ii) Economic value as producers of honey and as pollinators

- (2) Economic Entomology: (a) Description and life history of at least one economically important insect in the above orders (b) General principles of insect control - including natural, cultural, biological, and chemical

C. Plant Diseases -

Identification of the disease, organisms, life history, control, economic importance of one representative of rusts, smuts, viruses, mildews, leaf spot, bacterial blights.

Make reference to White Pine Blister Rust; Dutch Elm Disease; Dieback of Maples

III ANIMAL SCIENCE (20 periods)

- (1) Principles of live stock breeding - Pure breeding; grading; cross breeding; line breeding; outbreeding; inbreeding
- (2) Pedigrees: types, value. A study of the pedigree of an outstanding animal and its influence on the breed history
- (3) Reproduction in farm animals -  
Reproductive system: male and female; physiology; reference to diseases of the reproductive systems and other conditions which may cause sterility; Brucellosis testing and control by calfhoo vaccination; artificial insemination - definition, history, scope, advantages, disadvantages
- (4) Official live stock testing and improvement programmes
- (5) Animal health - common disorders, symptoms, prevention

- (6) The Dairy Industry - (a) scope; (b) factors involved in the production of high quality milk with reference to housing, sanitation, animal health and nutrition; (c) the secretion of milk and factors which influence composition; (d) production of: fluid milk, butter, cheese, ice cream, condensed milk, powdered milk; (e) quality testing and quality control of dairy products. (see chemistry section of grade 12)
- (7) Beef production: division; trends; housing requirements; market classification; cuts of meat; quality control with grades
- (8) Pork production: division; trends, housing requirements; hog grading; cuts of pork
- \*(9) Production of fur bearing animals

#### IV PLANT SCIENCE (10 periods)

##### Horticulture

- (1) A discussion of the divisions of commercial horticulture - nursery management, landscape design, greenhouse culture, floriculture, market gardening, arboriculture, seed production
- (2) Study of ONE of the following in detail:
  - (a) greenhouse production of a crop
  - (b) orchard or small fruit production; spray calendars
  - (c) market gardening
  - (d) commercial floriculture
  - (e) public parks and gardens

#### V ECONOMICS (24 periods)

- (1) Our economy: free enterprise; government action in the stabilization of incomes; employment and prices
- (2) Marketing: services related to the distribution of farm products (review)
- (3) Marketing: margin - relation of producer's price to what the consumer pays
- (4) Marketing:



(a) Marketing boards: objectives, formation, compulsory features.

Reference to marketing of winter wheat, sugar beets, canning vegetables, tobacco, live stock

(b) Price supports (Stabilization Board) - deficiency payments

(c) Price patterns, season cycles

(5) Farm Management:

(a) Management and its role in the farm business

(i) What management is

(ii) How management differs from technical skill

(ii) Subjects which management must study

(b) Kinds and sources of information needed by farm managers.

(i) The kind of information needed

(ii) Where to find the right information

(iii) How to develop your own information

(c) Farm accounts - (review grade 10)

(d) Analysis of farm account records

(i) Derivation of income statements

(ii) Derivation of efficiency measurements

(iii) Comparative analysis

(e) Making adjustments in the farm business

(i) With emphasis on labour use

(ii) With emphasis on capital use

(iii) With emphasis on land use

(iv) Adjustments to increase net earnings

(f) Finance and credit in the farm business

(i) Capital requirements for various types of farming

(ii) Sources of credit for farmers

(iii) Cost of credit

(iv) Preparation of credit application

- (v) Discuss the merits of owning or renting machinery  
with respect to capital requirements
- (g) Organization of farm family businesses
  - (i) Individual proprietors
  - (ii) Partnerships - basic guides and requirements
  - (iii) Corporations - legal requirements and objectives
- \*(8) Credit unions; government assistance in regard to credit
- \*(9) Public finance - expenditures of the levels of government; sources of  
revenue for each; direct and indirect taxation

This outline has been designed to give at least minimum attention to important economic considerations in farm management. Each area in this outline can be expanded to cover detailed material which can be provided, but it also requires that the instructor should have sufficient personal interest to illustrate the points from local observation and to provide homework assignments where required.

#### VI AGRICULTURAL ENGINEERING (20 periods)

- (1) Pulleys, gears
- (2) Farm water supply; irrigation; farm ponds or treatment and distribution  
of local water
- (3) Sewage and septic tanks
- (4) Farm power: electricity, types of electric motors; internal combustion  
engine (four and two stroke cycle)
- (5) Care, maintenance and storage of motors and machinery
- (6) Refrigeration and ventilation
- \*(7) Painting and improving home appearance

AGRICULTURE

GRADE 12

I PLANT SCIENCE (20 periods)

A. Introduction - Preference is given to topics which permit the development of scientific principles and promote the understanding of biological and agronomic concepts in operation on the ordinary farm.

(1) Research stations and experimental farms in Canada, personnel training, agricultural problems

(2) Variety concept: refer to classification of plants in grade 11 (Plant Science)

(a) Review of main field crops grown in Ontario with respect to the development of the variety concept

(b) Annuals - development of a new variety with reference to uniformity, derived from a single homozygous ancestor; common varieties: wheat, oats, barley, beans, tobacco, etc.

(c) Cross pollinated annuals - hybrid corn

(d) Cross pollinated perennials - e.g. Vernal alfalfa

(3) Review registered and certified seed production

(4) Growth patterns in field crops: - Structure of endospermous and exendospermous seeds e.g. corn, beans; germination patterns and emergence procedures; demonstrations to show germination period; emergence from different positions and depths; tillering (stooling); experiments to show growth points in the monocotyledon and dicotyledon; crown development as preparation for winter; growth pattern of forage crops

(5) Ecology of plant communities - natural

Ecology of a sward - change in plant population of a seeded field year by year. Compatible mixtures - grass-legume combinations. Plant successions. Effect of grazing and fertilization on maintenance of some plant types.



- (6) Application of crop science on the farm: Soil selection for specific crop; Crop rotations: seed bed preparation; fertility levels; seed selection; seeding procedures; control of competition; subsequent care.
- (7) Study of basic plant processes:
- (a) Growth: cell formation, enlargement, maturation, cell wall growth.
  - (b) Absorption: osmosis, diffusion, root pressure, capillary action
  - (c) Conduction; transpiration-pull; water cohesion theory; xylem; phloem
  - (d) Transpiration: action, factors affecting it
- (8) Photosynthesis (review from Grade 10 work)
- (a) where and when it occurs
  - (b) raw materials, products, and "overall" equation
$$6\text{CO}_2 + 6 \text{H}_2\text{O} \text{ ----- } \text{C}_6\text{H}_{12}\text{O}_6 + 6\text{O}_2$$
  - (c) energy exchange
  - (d) role of chlorophyll - (catalyst )
  - (e) intermediate compounds in the changes sugar  $\xleftarrow{\quad}$  starch and to proteins; a consideration of the environmental factors involved: light, heat, moisture, nutrients: these should be illustrated experimentally
- (9) Tremendous importance of chlorophyll to life on this planet. Discuss in relation to conservation of energy and as an essential life process not presently duplicated by man
- (10) The principles involved in the curing of hay
- (a) the stage at which it should be cut
  - (b) how rain and sun change its food value
  - (c) cause of spontaneous combustion and prevention

## II SOILS AND CONSERVATION (20 periods)

- (1) Soil organic matter - composition; variability, sources, decomposition, losses

- (2) Interrelationships in organic matter, nitrogen, microorganisms
- (3) Carbon cycle
- (4) Nitrogen cycle
- (5) Carbon - nitrogen ratio: maintenance of this ratio
- (6) Plant Nutrients and Fertilizers

(a) Naturally occurring sources of essential plant nutrients,  
presented to show:

- (i) natural sources slowly available
- (ii) bi-products of organic matter decomposition
- (iii) need for chemical fertilizers

(b) Role of N,P,K, - functions of nitrogen, phosphorous and  
potassium in a plant; deficiency symptoms

(c) Availability of N,P,K, in fertilizer: comparison of total and  
available N,P,K, in a fertilizer: advantages in having a  
fertilizer not all readily available. Carriers

(d) Methods of application - solid, liquid, gaseous - nutrients  
involved; crops adaptable, broadcast and bands

(e) Soil testing and recommendations:

- (i) comparison of amounts of N,  $P_2O_5$ ,  $K_2O$  and CaO removed  
from the soil by leaching and cropping
- (ii) types of nitrogenous fertilizers to determine  
relative solubility of nitrate form, the ammonium form  
and the organic forms
- (iii) a test to show the presence of a water soluble phosphate  
in superphosphate or in bone meal; shake in water,  
filter, and test filtrate with ammonium molybdate
- (iv) the test for water soluble potash in potassium chloride  
or potassium sulphate using a flame test on filtrate

- (f) Lime and minor elements - recall essential elements; natural deficiencies in calcium and/or magnesium compounds; testing for lime; amounts and method of application; the minor elements, function of each
- (g) Purchasing fertilizers - based on soil analysis, crop and crop rotation; the economy of higher analysis.
- (h) Fertilizer laws and regulations - examination of data on a fertilizer bag

(7) Soil Conservation

- (a) Soil as a basic resource - production of feed, shelter, clothing
- (b) Welfare of people and soil productivity - relate the downfall of nations to dwindling soil resources
- (c) Meaning of a land use - Using land according to its capability to produce; the problem of good land being lost to urban development, roads
- (d) Conservation measures: factors affecting the amount of erosion and control - change of cropping practices - strip cropping - reduce energy of rain drop - controlled run-off - increased filtration
- (e) Farm planning to achieve an improved use of land - the arrangement of fields; changes in crops, rotations and cultural practices
- (f) Integration of agriculture, forestry, wildlife -- at the farm level, county level, provincial level; discussions to show the application of land capability in planning for optimum use.
- (g) Conservation authorities in the area and legislation

III AGRICULTURAL CHEMISTRY (15 periods)

- (1) Chemistry of respiration - an oxidation process; release of energy; the products formed



- (2) Chemistry of seed germination - in changing stored food to forms that can be assimilated by young growing plants
- (3) Chemistry of fermentation - in bread making, in ensilage. Compare the ensiling of corn and sunflowers with their carbohydrates, and legumes with their proteins
- (4) Dairy Chemistry -
  - (a) Percentage composition of average milk
  - (b) Tests to show the presence of each
  - (c) Chemical changes that occur when milk sours
  - (d) Cause of souring and prevention
  - (e) Changes that occur in the curing and ripening of cheese
  - (f) Changes that occur when butter becomes rancid
  - (g) Babcock test for milk, cream
  - (h) Total solids-not-fat
  - (i) Chemical nature of "hard" and "soft" fats and how oleo-margarine is prepared
- (5) Chemistry of the ripening of fruits: apples, tomatoes, and corn
- (6) Examples of the chemicals involved in common insecticides, fungicides, and herbicides, auxins (hormones), pesticides, rodenticides; experiments to demonstrate

#### IV NUTRITION (15 periods)

- (1) Uses of hormones and antibiotics in animal nutrition
- (2) Practical experiments on nutrition
  - (a) Burn milk powder, grain, sugar to show relative ash contents
  - (b) Extract hay with dilute acid and alkali to show fibre remaining
  - (c) Extract fat from ground corn, meat meal, fish meal, with petroleum solvent, and evaporate to show visible fat residue
  - (d) Burn bone from chicken to demonstrate high residue of ash
  - (e) Chick growth with high and low protein levels
  - (f) Diet experiments on rats

(3) Hydroponics - Plant nutrition

- (a) Experiments on growing plants in nutrient solutions
- (b) Experiments on effect of lack of various elements on growth of plants

\*(c) Tissue testing of growing plants

(4) Chemistry of Digestion and Assimilation of Food:

- (a) definition of food
- (b) review chemical nature of main classes of foods - proteins, carbohydrates, fats, vitamins, minerals
- (c) types and examples of main classes of protein (and their extremely complex nature) casein (milk) albumen (eggs), chitin (insects); keratin (hair, scales, feathers, skin, hoof, claws)

(d) tests for protein:

- (i) Chars when heated and gives off an odour
- (ii) Forms  $\text{CO}_2$  if burned in air
- (iii) Gives off  $\text{NH}_3$  if heated in contact with soda lime
- (iv) Violet colour when dissolved in solution of sodium hydrate (add drop of dilute solution of  $\text{CuSO}_4$ )
- (v)  $\text{HNO}_3$  strong, warm, gives a yellow colour and if ammonia is added it turns orange

Structural formula of a simple amino-acid

content - C,  $\text{HN}_3$ ,  $\text{O}_2$ , S

(e) carbohydrates - chemical composition

sugars, starches, cellulose, gums - characteristic of each simple sugars - (carbon and water in the molecule)

mono-saccharides  $\text{C}_6\text{H}_{12}\text{O}_6$  - fructose

di-sacchardies  $\text{C}_{12}\text{H}_{22}\text{O}_{11}$  - sucrose

poly-saccharides - more complex ( $\text{C}_6\text{H}_{10}\text{O}_5$ ) starch, glycogen, gums, mucilages, pectin, cellulose.

Change when heated with mineral acids

(f) fats - chemical nature; alcohol, glycerol, ester. Occurrence in nature

(g) The chemical changes that occur when various foods are digested and assimilated for growth or repair or for oxidation for energy

## V GENETICS (20 periods)

(1) Review - basic principles of genetics (from Grade X Genetics)

(2) Inheritance of lethal genes - with an explanation of the results from a study of common examples of plants and animals

An advanced study of genetics with special reference to the following genetic principles: - inheritance of lethal genes; complementary gene inheritance; multiple alleles; sex chromosomes; linkage (translocation) mutations and reversion, incompatibility and sterility, parthenogenesis, hybrid vigour (inbreeding and outbreeding) tetraploidy with an explanation of the results obtained from a study of common occurrences in both plants and animals.

## VI MICROBIOLOGY (25 periods)

### Scope of Course

This course in microbiology emphasizes a study of the science in relation to agriculture. In this respect it could be called Agricultural Microbiology. Emphasis is placed on the bacteria and their role in agriculture, but mention is also made of the importance of other micro-organisms in this regard.

Much of the course is practical, the student observing and studying the various activities of micro-organisms by actually carrying out experiments which demonstrate these activities.

Some time should be taken up with a general discussion of the microscopic forms of life from the standpoint of (1) occurrence in nature, (2) their reproduction and physiology, (3) the part they play in the



processes of nature, (4) their helpful or harmful relation to each other, to plants, to lower animals and to man, and (5) their part in science and industry.

Detailed instructions are available for the experiments:

- (1) The preparation of a culture medium for growing micro-organisms
- (2) The simple staining of bacteria cells
- (3) The isolation of bacteria from various sources
- (4) Use of the compound light microscope
- (5) The isolation of moulds and yeasts from various sources
- (6) Microscopical examination of yeast cells in a moist mount
- (7) Fermentation by yeasts
- (8) The microscopical examination of some common moulds
- (9) Micro-organisms in water
- (10) Micro-organisms in sewage
- (11) The action of bacteria in milk
- (12) Food processing

Principles involved in the various methods of processing foods:

- (1) freezing (2) salting (3) sugar (4) vacuum pack (5) dehydration -  
plasmolysis (6) mercury vapour
- (13) The decomposition of various materials by soil micro-organisms
- (14) The root nodule of legume bacteria
- (15) A bacterial disease of plants
- (16) Methods of sterilization
- (17) Distribution counts of micro-organisms.

COURSE IN AGRICULTURE

Suggestions for Projects and Experiments  
for the Greenhouse, Classroom and Garden Area

Many of the experiments may be conducted by individual pupils or by small groups as research projects. Some may be considered as class experiments. -

1. Plant competition - grow several species alone and in mixtures to compare rate of growth, plant survival and yield.
2. Plant ecology and growth patterns - grow grasses and legumes to study growth patterns of each species. Clip to show effect of cutting or grazing.
3. To demonstrate the effect of herbicides on plant growth.
4. To show effect of stimulants, inhibitors, auxins and hormones.
5. Study growth habits of radiated seeds.
6. Special experiments related to effect of light, heat, moisture on growth, flowering, seed production.  
Effect of light control on flowering of grasses and clovers.
7. Hydroponics - to show symptoms of nutrition deficiencies.
8. Fertilizers - analyses, rates and methods of application on the growth of various farm and horticultural crops.
9. Seed production - grow turnips, carrots.
10. Elementary plant breeding - geranium, snapdragon, tomato, wheat.
11. Grow rooted cuttings or lining out stock as class projects.
12. Disease control: plant inoculations to show transmission of disease organisms - tobacco virus, rusts, mildew.
13. Grow cut flowers - chrysanthemums, snapdragon, carnation, sweet pea.
14. Grow potted plants for distribution to pupils and for classroom decoration.
15. Grow box plants for school ground improvement and for distribution to pupils.
16. Force plants for indoor bloom.
17. Plant propagation - seeds; cuttings - softwood and hardwood; grafting; budding; layering.

18. Experimental garden plots to illustrate:

- (a) Use of commercial fertilizers
- (b) Variety tests for local area
- (c) Value of weed killers
- (d) Soil management and maintenance of organic matter.

Other practical activities -

1. Management of a small apiary at the school or as a pupil project. Value of the observation hive.
2. Brooding of chicks for a short period.
3. Management of a small laying flock to study housing, rations, grading of eggs and poultry, anatomy of the bird - dissection.

NOTE: Pupils should be encouraged to conduct home projects. A well planned project carried to completion is a rewarding experience for those concerned. In rural districts participation in 4H Club activities is recommended.



REFERENCES

The school library should contain up to date reference material on all topics of the courses in Agriculture. Because of the wide scope of the sciences involved no one text can contain sufficient material for reference. Duplicate copies of many of the texts should be on open shelves in the agriculture laboratory for immediate reference by classes.

In addition to the list below supplementary mimeographed material will be available to the teachers.

Teachers will find the following publications excellent sources of reference material:

History of Agriculture -

Klages, ECOLOGICAL CROP GEOGRAPHY, Macmillan  
Reaman, TRAIL OF THE BLACK WALNUT, McClelland-Stewart  
ENCYCLOPEDIA CANADIANA  
FARMING IN CANADA, Canada, Department of Agriculture  
FARM LIFE IN ONTARIO, Ontario, Department of Agriculture

Soils and Conservation -

Chapman and Putnam, PHYSIOGRAPHY OF SOUTHERN ONTARIO, University of Toronto Press  
Donahue, SOILS-INTRODUCTION TO SOILS AND PLANT GROWTH, Prentice-Hall  
McConkey, CONSERVATION IN CANADA, Dent  
Millar, et. al., FUNDAMENTALS OF SOIL SCIENCE, John Wiley  
BULLETINS, Ontario, Department of Agriculture

Plant Science -

De LaMare, GARDEN GUIDE, General Publishing Company  
Hughes and Henson, CROP PRODUCTION, Macmillan  
Lawrence, PRACTICAL PLANT BREEDING, Macmillan  
Shoemaker, GENERAL HORTICULTURE, McClelland and Stewart  
BULLETINS, Canada, Department of Agriculture  
BULLETINS, Ontario, Department of Agriculture

REFERENCES (cont'd)

Genetics -

Begg, AN INTRODUCTION TO GENETICS, Macmillan  
Sinnott, et. al., PRINCIPLES OF GENETICS, McGraw-Hill

Animal Science -

Grout, THE HIVE AND THE HONEY BEE, General Publishing Company  
Lippincott and Card, POULTRY PRODUCTION, Macmillan  
MacEwan and Ewan, CANADIAN ANIMAL HUSBANDRY, Nelson  
Rice and Andrews, BREEDING AND IMPROVEMENT OF FARM ANIMALS, McGraw-Hill

Biology -

Hegner, COLLEGE ZOOLOGY, MacMillan  
Patten, EARLY EMBRYOLOGY OF THE CHICK, McGraw-Hill  
Urquhart, INTRODUCING THE INSECT, Clarke Irwin  
BULLETINS, Ontario, Department of Agriculture

Nutrition -

Maynard, ANIMAL NUTRITION, McGraw-Hill

Microbiology -

Conn, BACTERIA, YEASTS AND MOULDS IN THE HOME, Ginn

REFERENCES (cont'd)

Economics -

Beneke, MANAGING THE FARM BUSINESS, John Wiley

General -

Andrews,	AGRICULTURE FOR HIGH SCHOOLS, Gage
McColly and Martin,	INTRODUCTION TO AGRICULTURAL ENGINEERING, McGraw-Hill
Nadler,	MODERN AGRICULTURAL MATHEMATICS, Judd - Orange Judd Publishing Co. Ltd.